State of California
Regional Water Quality Control Board
San Diego Region

EXECUTIVE OFFICER SUMMARY REPORT
December 14, 2005

ITEM: 13

SUBJECT: Status Report: Total Maximum Daily Loads for Indicator Bacteria, Project I - Beaches and Creeks in the San Diego Region. *(Julie Chan and Christina Arias*)

PURPOSE: To provide the Board a brief introduction to the technically complex bacteria TMDLs in advance of the public hearing scheduled for February 8, 2006.

PUBLIC NOTICE: Public notice of this item was provided in the agenda for the December 14, 2005 meeting of the San Diego Water Board.

DISCUSSION: The San Diego Water Board plans to release the proposed *Total Maximum Daily Loads for Indicator Bacteria, Project I - Beaches and Creeks in the San Diego Region* for public review on December 9, 2005. This document describes TMDLs for indicator bacteria developed to address 17 of the 38 bacteria-impaired waterbodies in the San Diego Region as required by section 303(d) of the Clean Water Act.

Implementation of the TMDLs to attain bacteria water quality objectives in coastal and inland surface waters will mandate significant bacteria mass loading reductions by MS4 agencies and others to comply with bacteria wasteload allocations. The Board's proceedings to consider adoption of the TMDLs will be well attended and controversial. Thus, Board members will need to develop an understanding of the technical issues associated with both the indicator bacteria standards which the TMDLs are based on as well as the development of the TMDLs.

To protect public health, and as mandated in the Clean Water Act and equivalent State statutes, accurate, reliable, and scientifically defensible methods for determining whether, and to what extent, recreational and shellfish harvesting waters are contaminated by human pathogens is important. For more than 100 years, U.S. water quality regulatory agencies have relied extensively on an indicator organism approach to assess the microbiological quality of drinking water and as a basis for bacteriological water quality standards to protect the public health. More specifically, these enteric bacterial indicator microorganisms (predominantly

"coliforms") are used to detect the possible presence of microbial contamination of drinking water from human waste. Coliforms include several genera of bacteria belonging to the family Enterobacteriaceae, of which *Escherichia coli* is the most important member. The use of coliforms was later expanded and adopted for ambient, recreational, and shellfish waters and continues to focus on identification of fecal contamination.

One shortcoming of the present Ocean Plan and Basin Plan indicator bacteria water quality objectives is the lack of an established relationship between presently used indicators and health risk. For example, many reported exceedances of beach bacteria water quality objectives are associated with nonpoint source "non sewage" pollution (including largely uncontrollable sources of bacteria from bird and wildlife feces). However, the epidemiological studies used to establish the recreational bathing water quality objectives were based primarily on exposure to point source contamination dominated by human fecal material.

The present suite of indicator bacteria water quality objectives will be required for the foreseeable future because monitoring for the complete spectrum of pathogens that may occur in source waters for drinking water, and recreational and shellfish harvesting waters is not practical or feasible. Accordingly, the San Diego Water Board will proceed with consideration of TMDLs for bacteria-impaired waterbodies in the San Diego Region to attain and maintain indicator bacteria water quality objectives.

The San Diego Water Board and the USEPA coordinated a watershed assessment and modeling study to support the development of the indicator bacteria TMDLs. Because the climate in southern California has two distinct hydrological patterns, two models were developed for estimating bacteria loads and TMDLs. USEPA's Loading Simulation Progam in C++ was used to quantify loading during wet weather events (storms). Storm events tend to be episodic and short in duration, and characterized by rapid wash-off and transport of very high bacteria loads from all land use types. Because of the short duration of wet weather events, single sample water quality objectives (WQOs) were used as numeric targets for the wet weather TMDLs.

A steady-state mass balance model was developed to quantify bacteria loading during dry weather conditions. This model represents streams as a series of plug-flow reactors, with each reactor having a constant, steady-state flow and bacteria load. Dry weather loading is much smaller in magnitude than wet weather loading, does not occur from all land use types, and is more uniform than stormflow. Geometric mean WQOs were used as

numeric targets for the dry weather TMDLs because of the steady-state nature of the flow and loading simulations.

Both interim and final TMDLs were calculated for this project. The interim wet weather TMDLs were calculated using the reference system approach to implement the REC-1 water quality objectives. This approach allows the single sample WQOs to be exceeded at the same frequency as in a reference system. A reference system is a beach and upstream watershed that are minimally impacted by anthropogenic activities. The purpose of the reference system approach is to account for the natural, and largely uncontrollable sources of bacteria (e.g., bird and wildlife feces) in the wet weather loads that can, by themselves, cause exceedances of WQOs, but are not likely to be associated with human pathogens.

The interim wet weather TMDLs include an allowable exceedance load associated with a 22 percent exceedance frequency of the single sample REC-1 WQOs. Twenty-two percent is the frequency of exceedance of the single sample maximum WQOs measured in the Leo Carillo Beach/Arroyo Sequit Watershed reference system in Los Angeles County. The final wet weather TMDLs did not include an allowable exceedance load because the Basin Plan does not authorize the implementation of the single sample bacteria WQOs using a reference system approach. Consequently, the final wet weather TMDLs are significantly more stringent than the interim wet weather TMDLs. Final dry weather total coliform TMDLs utilized the SHELL WQO as a numeric target because this WQO is more stringent than the REC-1 WQO for total coliform.

Bacteria sources were quantified by land-use type since bacteria loading can be highly correlated with land-use practices. In this analysis, land-uses were categorized into14 general types. Loads generated by urban land uses were classified as point sources because of the likelihood that urban lands are drained by municipal separate storm sewer systems (MS4s). Loads generated by rural land uses were classified as nonpoint sources based on the likelihood that MS4s are absent in these areas. Loads generated on undeveloped lands were classified as non-controllable nonpoint sources based on the likelihood that loads from these lands are from wildlife sources. For each watershed, wasteload allocations were developed for municipal discharges and Caltrans discharges from urban lands. Load allocations were developed for controllable nonpoint source discharges that include agricultural and livestock facilities. Finally, load allocations were developed for non-controllable nonpoint sources from undeveloped lands. The TMDL documents will be available to the public on the Board's website on December 9, 2005, when the formal public review and

comment period begins. Board members will be provided a CD containing the documents at the December 14th Board Meeting.

KEY ISSUES:

1. The *critical point* for TMDL calculation was defined as the culmination point at the bottom of the watershed, before inter-tidal mixing takes place. Both current loading and total maximum daily loading was calculated at the critical point for each watershed in this study.

2. Each land use type had a unique modeling parameter describing the amount of wet weather bacteria loading based on area of land use. These parameters were obtained from studies supporting the bacteria TMDL for Santa Monica Bay. Land use characteristics for all categories in the San Diego Region were assumed sufficiently similar to characteristics of all land use categories in the Los Angeles Region. This assumption was validated through evaluation of model results with local water quality data.

3. Data from Aliso Creek, San Juan Creek, Rose Creek, and Tecolote Creek were used to generate dry weather regression equations describing flow and water quality as functions of land use composition and watershed size. Conditions in these four creeks are assumed representative of conditions throughout the Region, and the regression equations developed were used to model dry weather flow and bacteria loading in the other watersheds in this study.

4. Wet weather model hydrologic parameters were calibrated using 11 gaging stations located throughout the region, and validated using 13 stations. Hydrology data were insufficient to separately calibrate and validate hydrologic parameters for each watershed. Therefore, calibrated parameters were assumed applicable to watersheds not calibrated or validated. Since many of these watersheds share physical and climatic characteristics of the calibrated watersheds, this assumption was justified.

LEGAL CONCERNS: None.

SUPPORTING DOCUMENTS

1. List of Impaired Beaches, Creeks and Creek Mouths Addressed in Project I
2. Location Maps

RECOMMENDATION(S): None.